Considering now in further detail the encoded linear matrix image 4, and with reference to an exemplary matrix image 4 illustrated in FIG. 8, the matrix image 4 includes a header section 4a and a data section 4b. The data section 4b has a plurality of colored data marking regions 80 which form the encoded representation of the binary data 2. Each of the data marking regions 80 has a predetermined size and one of a set of predetermined colors. Each region 80 is preferably rectangular, having a number of pixels in a horizontal X direction and a vertical Y direction, with all rectangular regions 80 preferably of the same size. The number of regions 80 in each horizontal row of the data section 4b is determined by a safe image width 94 of the encoded matrix image 4.

Each data marking region 80 is representative of a predetermined amount of the binary data 2. The amount of binary data 2 that each region 80 represents is preferably determined by the number of discrete colors in the color choice set used for a region 80. For example, if there are 18 individual colors in the color choice set, then 4 bits ($2^4 = 16$) of binary data 2 can be encoded, using 16 of the 18 colors. It will therefore be apparent that the more colors available in the color choice set, the more bits of binary data 2 can be encoded in a single region 80, and the fewer regions 80 needed to encode a given amount of binary data 2. In addition, the numeric value of the binary data 2 represented by a region 80 corresponds to the particular color of the region 80. How the binary data 2 is encoded to form the colored data marking regions 80 will be described subsequently in further detail.

The size of each region 80, and the set of possible color choices that each region can assume, are determined based on the image-distortion characteristics 32 of the image data channel 40 over which the encoded matrix image 4 is to be transmitted. The channel 40 typically produces spatial distortion (for example, changing the size in the X and/or Y direction of a region 80) and/or color distortion (for example, changing the color of all or part of a region 80). To compensate for these distortions, the size and set of color choices for regions 80 are chosen such that the transformed data section 6b of the transformed linear matrix image 6 can be decoded into recovered binary data 8 with a high degree of accuracy. For a given degree of accuracy, a data section 4b for a channel 40 that produces greater distortion will have regions 80 of larger size, fewer color choices, or both. Conversely, a data section 4b for a channel 40 that produces less distortion will have regions 80 of smaller size, more color choices, or both. For a higher degree of accuracy, the data section 4b will have regions 80 of larger size, fewer color choices, or both.

Where the image-distortion characteristics 32 of the intended channel 40 can be specifically determined, an optimal data section 4b for that channel 40 can be constructed. If the image-distortion characteristics 32 of the intended channel 40 cannot be specifically determined, a worst-case data section 4b that can be successfully decoded for a variety of different channels 40 is built.

Considering now the header section 4a of the encoded linear matrix image 4, the header section 4a preferably includes a plurality of colored header marking regions 82.

Different subsets of regions 82 serve different purposes. One subset forms a detection key 84 for recognizing the transformed linear matrix image 6 within the stream of channel data transmitted over the image data channel 40, and for segregating the transformed linear matrix image 6 from the other channel data, such as data which is to be printed. The detection key 84 has a predetermined pattern, known to the linear matrix decoding subsystem 60, that is both easily detected and unlikely to occur in the other channel data. To ensure that the transformed matrix image 6 will be recognized, the pattern of the detection key 84 is preferably repeated at least once, and is preferably encoded using large region sizes and color sets having fewer color choices.

Another subset of colored header marking regions 82 forms a predetermined known tuning pattern 86 that is comparable to a transformed tuning pattern in the received linear matrix image 6 so as to define the image-distortion characteristics 32 of the channel 40. The tuning pattern 86 preferably has a set of header marking regions 82 of different sizes and colors. By comparing the size and color of regions in the transformed tuning pattern to those in the known tuning pattern 86, the image-distortion characteristics 32 can be determined. The image-distortion characteristics 32 are subsequently used to decode the encoding parameters in the header section 6a and the binary data in the data section 6b of the transformed matrix image 6.

An additional subset of colored header marking regions 82 forms a set of encoding parameter images 88 that represent the encoded versions of the encoding parameters 30 used to encode the binary data 2 into the data section 4b. Once the encoding parameters